

# LONGER LIFE FOR WOOD in Your Fencelines and Vineyards

Lawrence S. Hamilton and Gordon R. Cunningham



## Contents

	page
The cause of wood decay .....	3
Natural durability .....	4
Preservative treatments for posts and stakes .....	5
Commercial treatment .....	6
Pressure treatment .....	6
Commercial non-pressure treatment .....	7
Home treatment .....	8
Toxic oil treatments .....	8
Hot-and-cold bath .....	10
Cold-soaking .....	11
Treatment with water-borne preservatives .....	11
End-diffusion or pull-up method .....	12
Capping with glass jar .....	13
Stepping method .....	15
Double diffusion .....	16
Worthless or low value treatment .....	17
Precautions .....	17
Service tests .....	18
The problem of selecting a fence post or grape stake .....	18
Better service from other wood products .....	19
Useful references .....	23

September 1957

### ACKNOWLEDGEMENT

The authors are indebted to Dr. Wallace E. White of Pennsylvania State University School of Forestry, for his review of the manuscript and helpful suggestions.

# Longer Life for Wood

## In Your Fencelines and Vineyards

by LAWRENCE S. HAMILTON and  
GORDON R. CUNNINGHAM

### The Cause of Wood Decay

Wood fence posts and grape stakes, like old soldiers, never die. But on many New York farms they seem to "fade away" with singular rapidity. On almost every farm, there is an annual chore of replacing posts which have failed in service. In some cases they are not even replaced; new posts are simply added until the fenceline resembles a picket fence (figure 1). Each year 10 million posts and stakes are produced and put into service in New York. These posts fail not because of age, but because of decay which has broken down the wood structure, or because they

have been attacked by insects such as termites. Termites and other insects are only occasionally the cause of fence post failure on New York farms. Decay, which is caused by fungi, is the main object of your concern. These fungi are active in wood wherever favorable air, moisture and temperature conditions prevail. Since these favorable conditions exist for the greatest period of time in the upper soil zone, the phenomenon known as "groundline rot" is common (see figure 2). Wood above ground, where temperature and moisture conditions fluctuate more, may be sound. Wood at depths below



Figure 1. The continual addition of new posts to this failing fence line makes it resemble a "picket fence".



Figure 2. Groundline decay on a soft maple post. Because favorable conditions for fungi exist in the groundline zone, posts and grape stakes generally fail here initially.

eight or ten inches, where air conditions are not so favorable, may still be sound. But in the critical groundline area, the post breaks when subjected to pressure.

It is not practical to change air, moisture or temperature conditions, but you can lengthen the life of

posts by doing something about the food of these fungi—the wood itself. Certain chemical substances when impregnated in the wood can poison or inhibit the development of these decay organisms.

### Natural Durability

The *heartwood*, the dark-colored inner portion of a tree, contains various natural substances which have colored the wood and which make the wood less susceptible to decay. Heartwood is always more decay resistant than *sapwood*, the live, light-colored, outer portion of the tree (figure 3). The relative durability of the heartwoods of the different species varies with the amount and nature of these compounds. The heartwood of black locust for instance may be still sound after 50 years in contact with the ground, while heartwood white ash fails after only 4 years. The range in natural durability of various New York woods is indicated in table 1. If you have any Class A species in

Table 1. Estimated Durability of Heartwood of Native or Introduced Species Used as Posts in New York

Class A 20 years	Class B 10-20 years	Class C 5-10 years	Class D (Not over 5 years)	
Red Cedar	White oak	Slippery elm	White ash	Ironwood
Mulberry	Swamp white oak	Black cherry	Red oak	Black birch
Osage orange	Honey locust	Butternut	Black oak	Yellow birch
Black locust		Sassafras	Red maple	White birch
White cedar		Rock oak	Sugar maple	Tulip tree
		Hemlock	Hickory	Basswood
		Tamarack	White elm	Red pine
		European larch	Popple	Scotch pine
		White pine	Beech	Norway spruce
			Sycamore	

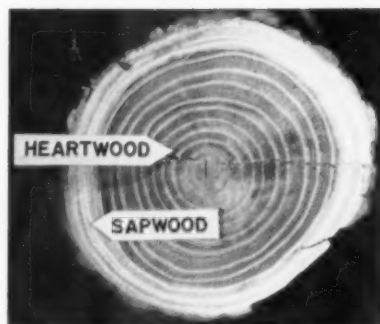


Figure 3. Black locust post with adequate heartwood for good service.

your farm woodlot, or can buy them at a reasonable price, they are virtually unexcelled as post material. But remember it is the *heartwood* that is durable. Sapwood black locust is no more durable than white ash or sugar maple (figure 4). Much of the white cedar on the market has so little heartwood that posts generally last no more than 7 or 8 years (figure 5). Class B species provide satisfactory service. Before using any species in classes C or D, you would be well advised to think about the merits of wood preservation—the artificial application of toxic chemicals to the wood in order to increase its useful life. Even Class A species may require such treatment if the posts are largely sapwood.

### Preservative Treatments for Posts and Stakes

The objective in wood preservative treatment is to impregnate an outer shell of wood with chemicals which are poisonous to decay fungi.

The amount of protection given to a post will depend on the nature of the preserving chemical, the depth it penetrates, and the amount of the chemical retained in the wood. Satisfactory penetration and retention of a selected wood preservative requires money and time. The results, however, are distinctly worthwhile and result in lower post costs in the long run. Normally non-durable species such as red pine may provide service in the fenceline or vineyard for 20 years or more if given adequate treatment with certain wood preservatives. A good wood preservative must not only be toxic to fungi, but should have good penetrating characteristics, be resistant to leaching by rain and soil moisture, be reasonably safe to

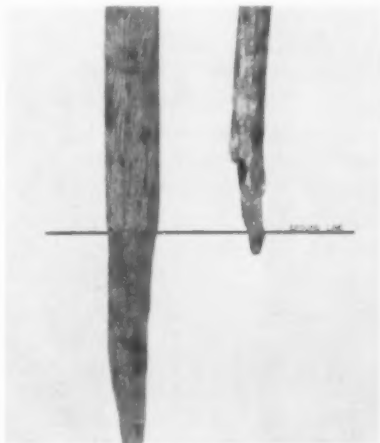


Figure 4. The split black locust post on the left has served 45 years in the ground and is still serviceable. It is mainly heartwood. The round black locust post on the right is mainly sapwood, and lasted only 3 years in a vineyard near Penn Yan.



*Figure 5.* There is considerable variation in the serviceability of white cedar posts. Many of the posts now on the market are like the post on the right, in that they have insufficient heartwood. It is possible to get good white cedar if you make certain the post looks like the one on the left.

handle, be reasonably cheap, be harmless to metal or the wood itself, and harmless to plants or animals which may come in contact with the treated material. Preservatives which meet these requirements to varying degrees and which have proved their value in actual field testing are now readily available. Methods of applying them have been adequately developed. Railways, utility companies, and highway departments fully recognize the value of wood preservation. You too would be well advised to look into this subject unless you can obtain the naturally durable species.

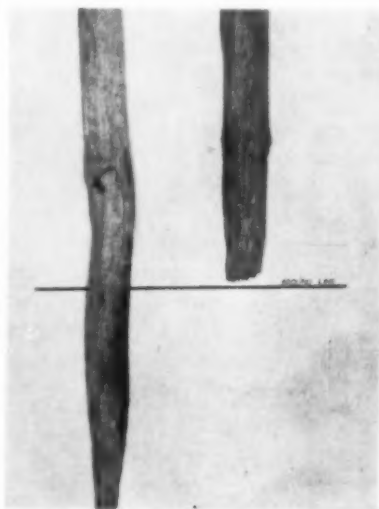
### Commercial Treatment

The commercial wood treating industry, by conforming to standards set by the American Wood Preservers' Association or to Federal Wood Preserving Specifications, produces dependable posts, poles and lumber, which now may be obtained

locally. Commercial treating methods may in general be classified as "pressure" or "non-pressure".

### Pressure treatment

Penetration and retention of wood preservatives can be most accurately controlled by putting them under high temperature and pressure in a closed cylinder. Many different wood preservatives are applied this way. The most commonly used, and one of the very best, is coal-tar creosote. Pressure-creosoted pine posts retaining 6 to 8 pounds of the toxic oil per cubic foot of wood, have an average service life of at least 30 years. Toxic oil-soluble salts of



*Figure 6.* These pine posts were installed the same year as fence-line neighbors on a farm in Otsego County. At the end of five years the untreated post had rotted off at groundline while the one treated with pentachlorophenol was still sound, and should continue to give service for at least 15 more years.

proven value, such as pentachlorophenol and copper naphthenate are also used in pressure treating. Certain water-soluble preservatives, such as Osmosalts, Wolman salts, zinc chloride, chromated zinc chloride and copperized chromated zinc chloride, give excellent results when applied by pressure, although they do not give protection for as long because they leach out more easily than the oil soluble preservatives. Lower initial cost may offset this disadvantage. In New York, only the pressure-creosoted posts are widely available, though it is possible to obtain other types from commercial wood preserving plants.<sup>1</sup>

#### Commercial non-pressure treatment

In New York, the most commonly available fence posts which have been commercially treated by non-pressure methods are those which are impregnated with Osmosalts. This proprietary product is a mix-

ture of sodium fluoride, disodium hydrogen arsenate, sodium chromate and dinitrophenol. Following immersion in a suspension of these salts, the treated posts are closely stacked and covered with moisture-proof material so that the salts will move into the wood. The treating is done by licensed dealers whose treating processes are inspected and supervised by the manufacturer. Service tests are not available for a wide range of species, particularly native New York hardwoods, but the chemicals used have proven value, and the penetrations obtained by this method are usually satisfactory. Results on pine and a few other species indicate that properly treated posts should last at least 15 to 20 years in service. Many of these licensed treaters will custom treat fresh-cut posts or lumber for you.

There are only a few small commercial treating plants in the State which treat by non-pressure methods using other preservatives. Most of these use pentachlorophenol, copper naphthenate or coal tar creosote and impregnate the wood by soaking it in an unheated solution of the pre-

<sup>1</sup> List of commercial treating plants for the current year may be found in "Wood Preservation Statistics", published by the Division of Forest Economics, U.S. Forest Service, U.S. Department of Agriculture, Washington, D. C.



Figure 7. The treating cylinder at a commercial pressure creosoting plant near Horseheads, N. Y.

servative. These small treating plants are not regulated, and you would be wise to make certain that their treatment conforms to the standards of the American Wood Preservers' Association. Posts properly treated with these toxic oils should last at least 15 to 20 years. The application of toxic oils by a hot-and-cold-bath process lends itself well to a small commercial operation. At present this process is seldom used in the Northeast.

### Home Treatment

If you desire lower initial cost than that which must be incurred for commercially treated posts, there are simple home treatments which are of proven value. You can treat posts cut from your woods to provide satisfactory and low cost service. In general, posts treated by simple home-applied methods will not last as long as those given proper commercial treatments. Yet if adequate penetration and retention are obtained, non-durable species may be protected to last 15 years or more (see Service Records, page 20).

The best method of assuring that sufficient preservative has been put into the wood is to carry out the treatment until a specified volume has been absorbed by each cubic foot of wood.

When treating a batch of posts in a tank, treat only *one species* at a time, since species vary in the rate at which they absorb preservative materials. Use posts as small in diameter as will meet your strength

requirements. They are easier to handle, easier to set and are most economical of preservative. Several small posts can be treated with the same volume of preservative as one large post (see figure 8).

Home treatments may be divided into two general classes, toxic oil treatments and treatments with water-borne preservatives. The former treatments in general give somewhat greater protection because the preservative is not so easily leached out of the wood, but the cost of toxic oil preservatives is generally a little higher.

### Toxic oil treatments<sup>2</sup>

Wood which is to be treated with toxic oils must be free of bark, dry and preferably round (since sapwood is more easily treated than heartwood). The bark is most easily and completely removed when posts are cut and debarked during the sap-peeling season (from May to mid-July in most parts of the State). Treating live trees with sodium arsenite will enable you to remove the bark with ease at other times of the year and will permit the wood to dry out slightly as it stands before cutting. This technique is known as "chemi-peeling" and is fully described in a leaflet of the Department of Conservation.<sup>3</sup> Other meth-

<sup>2</sup> Toxic oil treatments include both oils and oil-soluble salts.

<sup>3</sup> *Peeling Made Easy* by Lawrence S. Hamilton and David B. Cook, Mimeo Leaflet No. 6, Department of Conservation, N. Y. State College of Agriculture, Ithaca, New York. Rev. April, 1955.

ods of bark removal at other seasons will involve the use of a draw-knife. In this case, be careful to remove all of the bark including the stringy inner bark, for any adhering bark can prevent penetration of the preservative. To assure that the posts are dry, open-pile them in a loose crib-work-type pile so that air can circulate freely around each post. The bottom of the pile should be at least one foot above the ground. Hardwood posts should be shaded from direct sun if piled during mid-summer in order to prevent large seasoning checks. In good drying weather the posts will be ready for treatment at the end of two months. *Sharpening should be done before treating.*

The best toxic oil preservatives now available are coal tar creosote, pentachlorophenol and copper naphthenate. Treating solutions should

be prepared by diluting the concentrated solutions with kerosene or fuel oil to the following levels: Creosote—half and half; pentachlorophenol—5 per cent by weight; copper naphthenate— $\frac{1}{2}$  per cent metallic copper. Directions for dilution are generally printed on the containers by the manufacturer. Though the volume of preservative solution needed for one post or a batch of posts is small, it is necessary to buy and prepare enough solution so that the posts may be immersed in a tank. This initial "bank account" may be used over and over again, and even from year to year, if it is stored properly in water-tight containers. A small predetermined volume is added to this each time in order to treat a batch of posts. For example, it requires only 3 gallons of 5 per cent pentachlorophenol

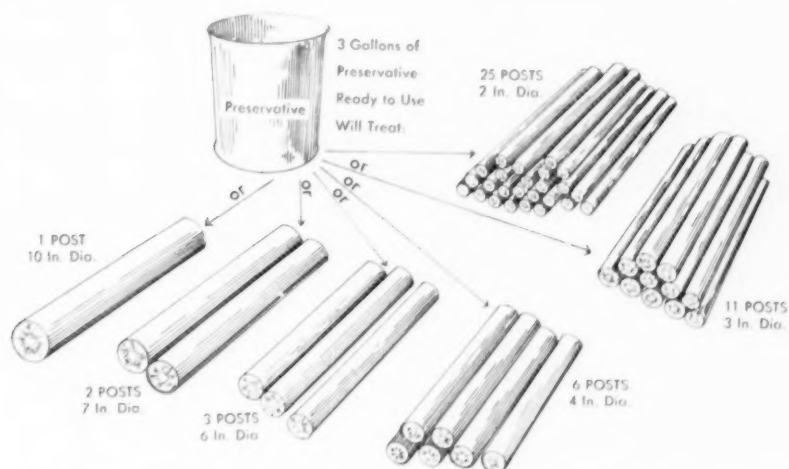


Figure 8. Toxic oil treatment protects the outer portion of the wood from decay. You may therefore use smaller diameter posts than is normally the case when untreated posts are used.

Table 2. Amount, in Pints, of Toxic Oil Preservatives Needed to Treat Each Post

Length in feet	Diameter at small end, inside bark, in inches										
	2"	2½"	3"	3½"	4"	4½"	5"	5½"	6"	6½"	7"
5'	½	1	1	2	3	3½	5	5½	6	8	9
6'	1	1½	2	2½	3½	4½	5½	6½	7	9½	11
7'	2	2	2½	3½	4	5½	6½	8	9	10½	12
8'	2	2½	3	4	5½	6½	8	9½	11	12½	14½

solution to treat a batch of 10 posts with small-end diameters of 3.5 inches and lengths of 6 feet, yet you may need 25 gallons of solution in order to get started. The volumes of treating solution needed to treat posts of various sizes is shown in table 2.

Best results are obtained if the posts can be treated full length at one time in a vertical position. You can make a treating tank for this purpose from an old boiler, or three 55-gallon drums welded together. Full length horizontal treatment is satisfactory. Suitable tanks may be made from metal drums (figure 9), or a stock-watering tank. If necessary, a single 55-gallon drum may be used and the posts treated one end at a time, but this is less satisfactory.

**Hot-and-cold-bath.** This is the best of the do-it-yourself treatments, for it will make well-treated posts last 20 years or more, on the average.

*method:* 1. Determine volume of preservative needed to treat all the posts in one batch from table 2.

2. Immerse the posts in a tank of preservative and

raise the temperature of the solution to 180°F.-200°F. Maintain this for 1 to 2 hours. Do not raise the temperature much above this point, since some of the oils may evaporate, and the solution may boil over the sides of the tank and ignite. The application of direct flame heat to a tank of these oils involves considerable hazard. This may be eliminated by using water in the hot bath and heating it to 200°F. for 2 hours. Such a modification has given good results in Georgia.

3. Transfer the posts to a tank containing the "cold" (preferably close to 100°F.) solution. Measure the depth of the solution. Add the calculated volume of preservative needed to treat the posts.
4. As the preservative moves into the wood,

the oil level will drop. When it reaches the original depth, remove the posts.

Best species to treat: oaks, beech, black locust, sycamore, white cedar, ashes, poplars, pines, tulip.

Another way of doing this, which involves the use of only one tank, is to stop the heating at the end of 1 or 2 hours and let the solution cool with the posts remaining in it. When the calculated volume has moved into the posts, as measured by change in solution level, the posts are treated.

**Cold-soaking.** Adequate treatment by this method should give posts an average life of 15 to 20 years. Creosote does not lend itself as well to this method as do the other two toxic oils.

*method:* 1. Determine volume of preservative needed in the wood to treat all posts in one batch from table 2.

2. Immerse posts so that batch is completely covered with treating solution. Measure depth of solution.

3. Add calculated volume of preservative for treating (see figure 9).

4. Allow posts to remain in solution until oil level has returned to original depth. This may take from 6 hours to a week. Posts are then treated and should be removed.

Best species to treat: oaks, pines, black cherry, birches. If a single 55-gallon drum is used, immerse the posts, butt down, to the halfway mark on the posts and add just over half of the calculated preservative required to treat. When the butts are treated, then treat the tops, adding the balance of the calculated amount. Longer posts and grape stakes require a deeper tank for treatment.

### Treatment with water-borne preservatives

Fence posts which are to be treated with water-borne preservatives must be freshly cut, round, and have the bark on (except for double diffusion method). *Sharpening should be done prior to treatment.* Treatment must be carried out within a few days of cutting; the shorter the interval the better—the day of cutting is best.



Figure 9. Horizontal treating tank made from welded metal drums with a portion of the sides cut off.

The most satisfactory and commonly used chemicals are zinc chloride, chromated zinc chloride and copper sulphate. These are readily available in crystalline form and are the least expensive materials which do a satisfactory job. Copper sulphate (blue vitriol) has the disadvantage of being corrosive to metals and therefore requires wooden or concrete containers for treating tanks. No trouble with fence wire or staples has been encountered where bark has been left on and galvanized or heavy gauge staples used.

Since the posts are not totally immersed in the treating solution, nothing more elaborate than a water-tight barrel, 55-gallon drum, glass jars or buckets are required for any of the techniques of application.

There are several methods of introducing the treating solution into the wood. Select a method which fits into your work schedule most satisfactorily. Properly treated posts should have an average life service of approximately 15 years.

#### *End-diffusion or pull-up method.*

This treatment works best during the summer months when temperatures are high. Volumes of preservative needed are given in table 3.

- method:*
1. Prepare a treating solution mixed at the rate of 4 pounds per gallon of water for zinc chloride and copper sulphate or 3 pounds per gallon for chromated zinc chloride.
  2. Determine volume needed to treat entire batch using table 3.
  3. Place posts with *butt* ends down in barrel or tank. Pour in about 6 inches of treating solution, or if posts are sharpened, *enough to cover the exposed wood.*
  4. Add the calculated volume of preservative for treating.
  5. Cover the tops of the posts with a layer of the dry crystals.

Table 3. Amount, in Pints, of Water-Borne Preservatives Needed to Treat Each Post by End-Diffusion Method

Length in feet	Diameter at small end, inside bark, in inches										
	2"	2½"	3"	3½"	4"	4½"	5"	5½"	6"	6½"	7"
5'	½	¾	¾	¾	1	1	1½	2	2	2½	3
6'	¾	1	1	1	1	1½	2	2	2½	3	3½
7'	¾	1	1	1	1½	2	2	2½	3	3½	4
8'	1	1	1	1½	2	2	2½	3	3½	4	5



Figure 10 (a) & (b). Pull-up method of treating fresh-cut posts with bark on.

6. When the calculated volume has been absorbed through the ends of the posts, remove posts and store them under shade with *tops down* for a seasoning period of at least 30 days while the preservative distributes itself by diffusion within the wood.

Best species to treat: pines, oaks, poplars.

**Capping with glass jar.** Individual posts may be treated any time of the year when the wood is not frozen (the warmer the temperature, the more rapid the treatment) by capping the post with a container of preservative. Gravity will force the

solution into the post and replace the sap in the wood with the wood preservative. The volumes of treating solution required for various sizes of posts are given in table 4.

*method:* 1. Mix treating solution at the rate of 2 pounds per gallon of water for zinc chloride and copper sulphate, or  $1\frac{1}{2}$  pounds per gallon for chromated zinc chloride.

2. Determine from table 4 the volume of preservative solution needed for each post. Pour this into a glass jar of appropriate capacity. The jar mouth must be smaller than the small end of the post to

Table 4. Amount, in Pints, of Water-Borne Preservatives Needed to Treat Each Post by Glass Jar Method

Length in feet	Diameter at small end, inside bark, in inches										
	2"	2½"	3"	3½"	4"	4½"	5"	5½"	6"	6½"	7"
5'	½	½	1	1½	2	2½	3	3½	4½	5	6
6'	1	1	1	2	2½	3	3½	4½	5	6	7
7'	1	1½	1½	2	3	3½	4½	5	6	7	8
8'	1	1½	2	3	3½	4½	5	6	7	8½	9½

be treated. The jar lid may be used if it has half a dozen large nail holes punched in it.

3. From burlap or any other coarse cloth material cut a "wick" the same shape as the small end of the post and slightly smaller in size, yet covering the area inside the bark.

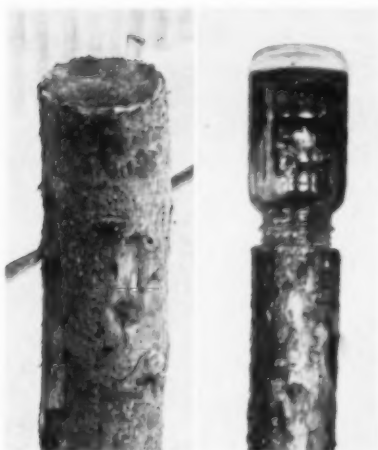


Figure 11 (a) & (b). Glass jar method of post treating showing wick on top of post and inverted jar.

4. Stand post upright, butt end down, against some support so that the cut surface at the top of post is horizontal.
5. Wet the wick and lay it on the top of the post. Quickly invert glass jar onto the wick. Shift post until no solution is seeping over the edge.
6. When contents of jar have gone into post, refill if necessary to put in the calculated volume.
7. Store treated posts butt-end down under shade for a seasoning period of 30 days in order to prevent serious checking. If need is urgent, however, posts may be put in service immediately.

Best species to treat: pines, oaks, hemlock, black cherry, black birch, gray birch, poplars, tulip, sapwood black locust, basswood, white ash, red maple.

On a warm day a post may be treated by this method in only a few hours. Though each post must be treated individually, the labor required to treat a dozen posts each day until post requirements are satisfied is not very great. A modification of this method using tire inner tubes as a capping container is described in another publication.<sup>4</sup>

**Stepping method.** If during the growing season, a tree is cut so that it "hangs up", and the butt is lifted off the stump and placed in a container of water-borne preservative, the solution will be absorbed and transported throughout the tree. This method of treatment is known as "stepping". It is particularly adapted to the treatment of poles from forest plantation thinnings, where each tree that is cut invariably hangs up in the dense crowns of its neighbors, even when you try to avoid this situation. A tree up to 10" in butt diameter may be slipped off its stump into a tub or bucket without too much manual effort. Best intake of the treating solution occurs during the growing season when the transpiration rate is high. Distribution of the treating solution within the wood is somewhat erratic, but quite suitable if the stem is to be used in one piece, as a small pole. If it is cut up into posts after treatment, the amount of preservative in

the upper posts may not be sufficient to afford really successful protection. Volumes needed to treat poles or stem sections of various sizes are given in table 5.

- method:* 1. Mix a treating solution at the rate of 1 pound per gallon of water for zinc chloride and copper sulphate or  $\frac{3}{4}$  pound per gallon for chromated zinc chloride.
2. Determine volume of preservative needed to treat usable length of stem from table 5. This will involve estimating the length of usable stem in feet and esti-



Figure 12. Treating red pine by stepping method.

<sup>4</sup> "Tire-Tube Method of Fence Post Treatment" by George M. Hunt and R. M. Wirka. Report No. 1158 Forest Products Laboratory, U.S. Forest Service, Madison, Wisconsin, 1938.

Table 5. Amount, in Quarts, of Water-Borne Preservatives Needed to Treat Each Usable Stem by Stepping Method

Length in feet	Mid-diameter, outside bark, in inches						
	4"	5"	6"	7"	8"	9"	10"
8'	3	4½	6	8½	11	14	17½
9'	3	5	7	9½	12½	16	19½
10'	3½	5	8	10½	14	17½	22
11'	4	6	8½	12	15½	19½	24
12'	4	6½	9½	13	17	21	26
13'	4½	7	10	14	18	23	28
14'	5	7½	11	15	19½	24½	30½
15'	5	8	12	16	21	26½	32½
16'	5½	9	12½	17	22½	28½	35

measuring the diameter of this portion of the stem at one half its length, outside bark.

3. Cut the tree, leaving a stump as high as the tub or bucket so that tree may be slipped off the stump into container with a minimum of lifting. Allow tree to "hang up".
4. Place butt end of tree in the container.
5. Pour in enough solution to cover the butt, then add the calculated volume to treat the tree. If the container will not hold all the required volume at one time, it may be necessary to add part of the solution later.
6. Allow tree to remain in this position for 14 days.

7. Pull tree down and buck to length.

Best species to treat: pines.

**Double diffusion.** A relatively new method of treatment involving the use of two water-borne preservative solutions has been developed at the U. S. Forest Products Laboratory. *Fresh cut, peeled* posts are steeped for several days in a solution of copper sulphate and then in a solution of sodium chromate. The two chemicals react to form a toxic compound which is almost insoluble in water and which therefore will not leach readily from the wood. This technique is fully described in one of the Forest Products Laboratory reports.<sup>5</sup> It may be possible to put each of these solutions into the wood by any of the methods already discussed

<sup>5</sup> "How to Treat Fence Posts by Double Diffusion" by Roy H. Baechler. Report No. 1955, Forest Products Laboratory, U.S. Forest Service, Madison, Wisconsin, 1953.

for treating green posts with the bark on. This will double the amount of work involved but may mean extra service life. Tests on pine have shown the value of this method, and preliminary results on several hardwoods look promising.

### **Worthless or Low Value Treatment**

When wood is exposed to high decay hazard, as when it is on the ground or in the ground, superficial treatments by dipping, brushing on or spraying on wood preservatives will not give worthwhile protection. This type of treatment is satisfactory for lumber which will be used outside, but not for posts, poles, or sills and runners which rest on the ground.

Paint is not a toxic wood preservative. It will make the wood look more attractive, but will not prevent decay. Linseed oil, whitewash, fuel oil, kerosene and other petroleum oils alone will not appreciably increase post service life; nor will charring the post add to its serviceability. If you are going to take the time and invest labor in applying some type of protective material to your posts, use a proven wood preservative and a method of treating which will assure adequate penetration and retention of the material.

Many people who treat their own fence posts will short cut and treat only the bottom portion of the post.

While this may be satisfactory in treating some species already possessing reasonable natural durability, it is not adequate for most New York species. Decay may occur in the tops of posts which are half-treated, and render the post useless while it is still sound at the groundline area.

### **Precautions**

Wood preservatives should be treated with respect since they are toxic to plant and animal life. Do not leave treating solutions where children or animals might drink them. A few of the preservatives may cause skin irritation to some people. Creosote oil in particular gives trouble, and pentachlorophenol will bother some people. It is a good idea to wear oil or waterproof gloves when treating posts or handling freshly-treated wood, and to avoid splashing the solution onto your skin.

Young tender plants or parts of plants may be "burned" by freshly-treated wood when certain preservatives are used. Most of the trouble seems to be the result of fumes from the volatile diluting oil, and occurs when wood is placed adjacent to plant tissue immediately after treating. Thousands of grape stakes treated with different preservatives have been used without damage to the vines. Nevertheless, be sure to allow freshly-treated posts to dry off before installing them in a vineyard.

### Service Tests

Many methods are utilized to test the value of new preservatives and new techniques of application. Laboratory tests and accelerated service tests using small stakes or veneer strips give indications of the relative effectiveness of these materials and methods. In the final analysis, however, the real test of value is in service testing using actual fence posts of various species which are set out in fence lines or in test "graveyards" (see figure 13). Because of the amount of work involved in setting up controlled fence post tests, and the long period of time required to assess performance, results are relatively few in number and are slow in being amassed for each region of the United States. Those service tests which seem ap-

plicable to New York State species and conditions are summarized in table 6.

### The Problem of Selecting a Fence Post or Grape Stake

You face a rather bewildering array of species, preservatives and methods of treatment as you try to make a decision about obtaining new replacements for your fenceline or vineyard. Your choice will be partly dictated by the availability of funds for a direct cash outlay or the availability of labor and wood for doing your own treating.

The true cost of a post is most adequately represented by the cost per post per year in service. Using this as a yardstick, it often works out that the post with a high initial cost may be cheapest in the end.



Figure 13. Fence post test "graveyard" at Cornell's Arnot Forest.

Judged in this light, it is difficult to see why so many New York farmers use non-durable species without treatment, even though the only cost is the labor of cutting them and installing them. Currently, labor costs are high and untreated, non-durable posts are very expensive when you consider that they last only 3 to 5 years.

Why not check on the alternatives available to you in your particular area of the State and do a little cost analysis on a per post per year basis? As a guide, some representative post costs and treating costs are given in table 7. These data are relative and represent averages. Substitute your own current cost data to fit your situation. Remember, too, that although the yearly cost per post of pressure-treated posts and posts treated by water-borne preservatives may be almost the same, there is the physical inconvenience of replacing the latter twice during a 30 year span, while the former remain in service for that time without attention.

### **Better Service From Other Wood Products**

Even a casual glance around your farm will reveal other places where wood decay is costing you needless dollars. Here, too, the proper selection of naturally decay-resistant wood, or the application of wood preservatives will pay off in increased serviceability.

Where decay conditions are high, as in sills, foundations, timbers, runners, bridge timbers, silos and poles, use only durable species (classes A and B, table 1) or use material thoroughly impregnated with wood preservative. Since these items are not easily replaced without serious disturbance, you should obtain commercially treated wood if possible. This is particularly true in the case of poles for the many pole-type buildings which are currently so popular. If it is necessary to treat these at home, most of the techniques already described may be modified, using larger equipment.

Where the decay condition is not as high but is still important (as in wagon boxes, porch steps, window frames or any place where two wood surfaces are joined in an outdoor structure), wood preservatives may be brushed on or sprayed on to good effect. Best results are obtained when the wood is dry and the toxic oil preservatives are used. They should be sprayed on or flowed on by brush, but not brushed out. Two applications are recommended. Use solution strengths similar to those for post treatment. If you wish to paint the wood afterwards, you will have to use special formulations of these preservatives or special solvents so that neither the preservative nor the solvent "bleed" through the paint.

Injury to young plants has resulted when creosote or penta has been used to treat flats or other plant

Table 6. Post Service Records

Species	No treatment	Hot & cold bath (coal-tar creosote)	Cold soak (penta or copper naphthenate)	Water-soluble preservatives End diffusion	Capping
Ash	8.0	13.9†	13.8 K		12.10 TU
Aspen and poplar	3.5	28.5; 16.10; 8.6†	9.10; 10.10 EF, 6.10 G, 7.4 K	15.10 FR, 7.9 Q	16.8 TU, 16.5 V
Basswood	1.0	28.6; 13.8			5.5 T, 14.8 T
Beech		31.9			
Birch	6.6, 6.0		7.10 DN, 12.10 F	11.5 P	13.9 TU, 13.5 T
Butternut		11.5†			14.5 T
Cherry, black	4.5		9.8 G, 13.8 K		14.5 T, 12.10 TU
Chestnut	19.4	25.5			
Elm, white	5.0	10.1	13.8 K	8.10 R	
Hemlock	8.6				
Hickory	5.0	10.4	9.4 D, 13.7 K, 10.10 M		12.10 TU
Larch, European	4.5	6.10	6.8 D, 6.10 FN, 5.10 G, 5.10 O	8.10 R	11.5 T, 6.5 T
Larch, Japanese	4.5	6.10	5.10 GO, 6.10 N		
Locust, black	31.7	31.6, 14.10			14.5 T, 14.10 T
Maple	5.4	31.5, 28.5, 12.9	12.2 H, 13.5 K	8.10 R	12.10 TU, 13.7 W
Oak, red & black	6.5	31.10, 28.7; 15.9	19.9 BC, 10.10 DEF, 13.9 K	7.9 Q, 8.10 R	14.9 TU
Oak, white	14.8	31.7, 15.9	9.8 D, 6.8 G	7.10 Q	14.5 T, 14.10 TU
Pine, jack	6.0		11.10 CDF, 7.10 N	8.10 Q, 7.9 R	10.10 T
Pine, red	3.3	6.10	9.10 D, 6.10 FO	8.10 R	15.8 TU
Pine, Scotch	1.2	6.10	6.10 DN, 5.10 GO		15.8 TU

Table 6. Post Service Records (Continued)

Species	No treatment	Hot & cold bath (coal-tar creosote)	Cold soak (penta or copper naphthenate)	Water-soluble preservatives End diffusion	Capping
Pine, white	5 (6)	14 (10)	12, 4°CDEF, 13, 8°HJKL	15, 10°Q, 8, 10°R	14, 10°TU
Red cedar	3, 5*, 14, 7	31 (10)	9, 5°D, 6, 10°F	8, 10°R	15, 10°TU
Spruce, Norway	2 (5)	31 (10)	7, 10°DN		15, 9°T
Sycamore					
Tamarack					
Tulip tree	4 (0)	31 (9)			
White cedar	7, 7*, 14, 9	25, 10	7, 10°DN, 13, 5°K		11, 5°T
Willow		28, 5			

\*Sapwood Posts    † — half round,  
‡ — split

LEGEND: example—13, 5°K means, after 13 years in ground 5 of every 10 posts are still sound after cold soaking in 10% penta solution for 48 hours in a horizontal tank.

## Vertical Tank

B — Penta, 5% in fuel oil,	8 hrs.
C — " "	24 " "
D — " "	48 " "
E — " "	96 " "
F — " "	168 " "
G — " "	?

## Horizontal Tank

H — Penta, 10% in fuel oil,	18 hrs.
J — " "	24 " "
K — " "	48 " "
L — " "	72 " "
M — " "	168 " "

N — Copper naphthenate, in fuel oil, 48 hrs.

O — " "

P & T — Zinc chloride

Q & U — Chromated zinc chloride

R & V — Copper sulfate

W — Copper sulfate & sodium chromate (double-diffusion)

Table 7. Representative, Relative, Dollar Cost per Post per Year for 3' Small Diameter Post 6 Long.\*

Type of post or method of treatment	Cost of post	Cost of preservative and treating	Total cost of post in ground	Expected service in years	Cost per year
Split black locust, untreated (purchased)	.60		.75	30 +	.02-.03
Round white cedar, untreated, little heartwood (purchased)	.45		.60	7-10	.06-.09
Common non-durable species, untreated, unpeeled. (Cut from own woods)	.25		.40	3-5	.08-.13
Pressure treated post (commercial) (purchased)	1.20		1.35	30	.04-.05
Post treated at home by cold soaking in toxic oils. (Cut from own woods)	.40	.30	.85	15-20	.05-.06
Post treated at home by hot-and-cold bath in toxic oils. (Cut from own woods)	.40	.45	1.00	20 +	.04-.05
Post treated at home with water-borne preservatives. (Cut from own woods)	.25	.20	.60	12-15	.04-.05

\* Cost figures used were as follows. Cutting and hauling post—25¢, sharpening—5¢, peeling—15¢, piling and handling for seasoning—5¢, driving—10¢, fuel and extra handling for hot and cold bath—15¢, handling post for other treatment—15¢, cost of toxic oil solution—15¢, cost of water-borne preservative—5¢.

containers. Consult crop specialists at the College of Agriculture if there is any possibility of this type of chemical injury. A safe preservative can be recommended by them.

For advice on any specific problems you may have in connection with wood preservation, write to your Extension Forester at the New York State College of Agriculture, Ithaca,

New York, or to the Forest Products Laboratory, U.S. Forest Service, Madison 5, Wisconsin. A list of sources of wood preservatives may be obtained from your County Agricultural Agent or from your Extension Forester. The following list of publications which provide additional information may also be helpful.

## Useful References

- Baechler, R. H., *How to Treat Fence Posts by Double Diffusion*. Report No. R1955. USDA, Forest Products Laboratory, Madison, Wisconsin, 1953.
- Blew, J. O., Jr., *Treating Wood in Pentachlorophenol Solutions by the Cold-Soaking Method*. Report No. R1445. Forest Products Laboratory, Madison, Wisconsin, 1950.
- , *Wood Preservatives*. Report No. D149. USDA, Forest Products Laboratory, Madison, Wisconsin, 1953.
- , *Comparison of Wood Preservatives in Mississippi Post Study*. Report No. 1757. USDA, Forest Products Laboratory, Madison, Wisconsin, 1956.
- and F. J. Champion, *Preservative Treatment of Fence Posts and Farm Timbers*. Farmers' Bulletin No. 2049. U.S. Dept. of Agr., Washington, D. C., 1952.
- and J. W. Kulp, *Service Records on Treated and Untreated Fence Posts*. Report No. 2005. USDA, Forest Products Laboratory, Madison, Wisconsin, 1954.
- Conway, E. M. and R. L. Schnell, *The Hot Water Bath—Its Use in the Treatment of Pine Posts*. Technical Note No. 19. TVA, Norris, Tennessee, 1953.
- Dominion Range Exp. Sta., *The Bluestone Treatment of Poplar Posts*. Leaflet. Maniberry, Alberta, Canada.
- Goodwin, W. R. and Others, "Report of Committee U-5, Post Service Records." American Wood-Preservers' Association, *Proceedings*, (1949) pp. 8-45.
- Hamilton, L. S., *Getting Better Service from Fence Posts*. Mimeo Leaflet, rev., No. 8, Dept. of Conservation, Agr. Ext. Serv., Ithaca, New York, 1953.
- and D. B. Cook, *Peeling Made Easy*. Mimeo Leaflet, rev., No. 6, Dept. of Conservation, New York State College of Agriculture, Ithaca, New York, 1955.
- Hicock, H. W. and A. R. Olson, *Preservation of Wood by Simple Methods*. Conn. Agr. Exp. Sta. Bull. 581. New Haven, Connecticut, 1954.
- Hunt, G. M. and G. A. Garrett, *Wood Preservation*, 2nd ed. McGraw-Hill Book Company, 1953.
- Hunt, G. M. and R. M. Wirka, *Tire-Tube Method of Fence Post Treatment*. Report No. 1158. Forest Products Laboratory, Madison, Wisconsin, 1938.

- Larsson, H. C., *Preservation of Hardwood Fence Posts*. Research Report No. 32. Div. of Research, Ontario Dept. of Lands and Forests, Toronto, Ontario, 1955.
- MacLean, J. D., *Preservative Treatment of Wood by Pressure Methods*. Agriculture Handbook, No. 40, U.S. Dept. of Agr., Washington, D. C., 1952.
- McNeal, Xzin, *Tests of Fence Post Preservatives*. Agr. Exp. Sta. Bull. 519. University of Arkansas, Fayetteville, 1952.
- Neetzel, J. R., R. L. Hossfeld and C. K. Otis, *Small Treating Tank for On-the-Farm Applications of Wood Preservatives*. Technical Note, No. 454. Lakes States Forestry Exp. Sta., St. Paul, Minnesota, 1956.
- Northeastern Wood Utilization Council, *A Guide to Wood Preservatives and Preservative Treatments*. Bulletin 44. New Haven, Connecticut, 1955.
- O'Neil, W. J., *Tests on Treated Posts*. Agr. Exp. Sta. Bull. 612. University of Missouri, Columbia, Missouri, 1954.
- U.S. Dept. of Agr., Forest Products Laboratory, *Selecting a Suitable Method for Treating Fence Posts*. Report No. R1468. Madison, Wisconsin, 1946.
- , *Methods of Applying Wood Preservatives*. Report No. D154. Madison, Wisconsin, 1953.
- , *Preservation of Timber by Steeping Process*. Report No. 621, rev. Madison, Wisconsin, 1954.
- , *List of Publications on Wood Preservation*. Report No. 704. Madison, Wisconsin, 1956.
- , *Making Log Cabins Endure*. Report No. 982. Madison, Wisconsin, 1956.
- Walters, C. S., *Experimental Treating Plant Built at Dixon Springs*. Forestry Note, No. 23. Agr. Exp. Sta., University of Illinois, Urbana, 1951.
- , *Used Crankcase Oil Not Recommended for Preservative Diluent*. Forestry Note, No. 42. Agr. Exp. Sta., University of Illinois, Urbana, 1953.
- , *Vertical Treatment of Posts Superior to Horizontal Treatment*. Forestry Note, No. 68. Agr. Exp. Sta., University of Illinois, Urbana, 1956.
- and H. W. Fox, *Hand-Peeling Fence Posts Compared to Mechanical Peeling*. Forestry Note, No. 31. Agr. Exp. Sta., University of Illinois, Urbana, 1952.
- Walters, C. S. and K. R. Peterson, *Report on Project 301-C. Preservative Treatment of Fence Posts with Toxic Oil Solutions by Cold-Soaking, Dipping, and Brushing*. Forestry Note, No. 64. Agr. Exp. Sta., University of Illinois, Urbana, 1955.
- , *Report on Project 301-A. Preservative Treatment of Fence Posts by Cold-Soaking in Pentachlorophenol-Fuel Oil Solutions*. Forestry Note, No. 70. Agr. Exp. Sta., University of Illinois, Urbana, 1957.
- and H. W. Fox, *Diameter of White Pine Posts No Indicator of Service Life*. Forestry Note, No. 71. Agr. Exp. Sta., University of Illinois, Urbana, 1957.
- White, W. B., *Comparative Durability of Posts from Trees Grown in Pennsylvania Woodlands*. Progress Report, No. 123. Agr. Exp. Sta., Pennsylvania State University, University Park, 1954.
- Willford, B. H., *Chemical Impregnation of Trees and Poles for Wood Preservation*. Circular No. 717. U.S. Dept. of Agr., Washington, D. C., 1944.

Cooperative Extension Service, New York State College of Agriculture at Cornell University and the U. S. Department of Agriculture cooperating. In furtherance of Acts of Congress May 8, June 30, 1914. M. C. Bond, Director of Extension, Ithaca, New York.